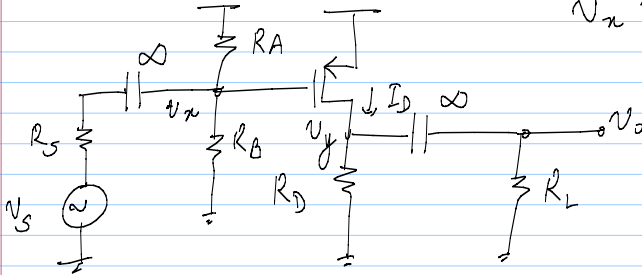


30/9/14

## lec 29

$$v_x \approx v_s \Rightarrow R_A \parallel R_B \Rightarrow R_S$$



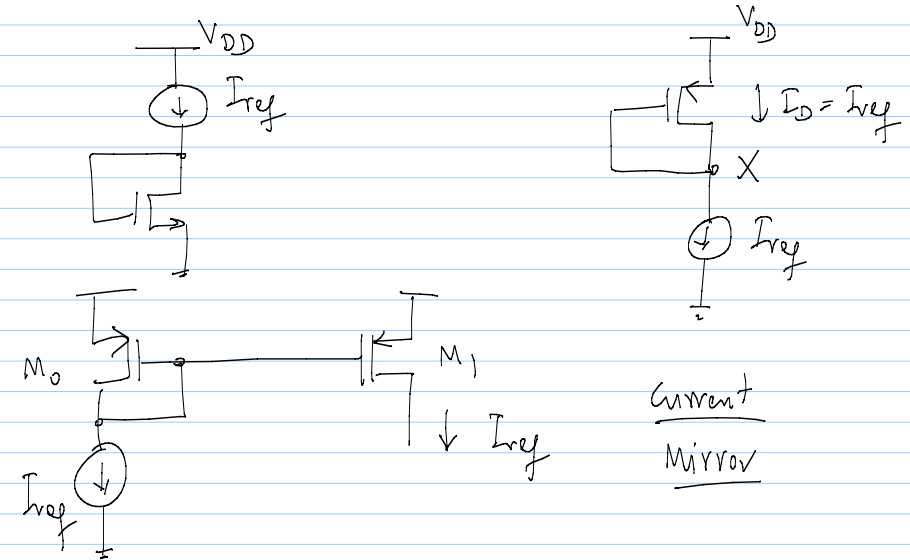
$$V_{y,q} = I_D \cdot R_D ; V_{x,q} = \frac{R_B}{R_A + R_B} \cdot V_{DD}$$

For sat.,

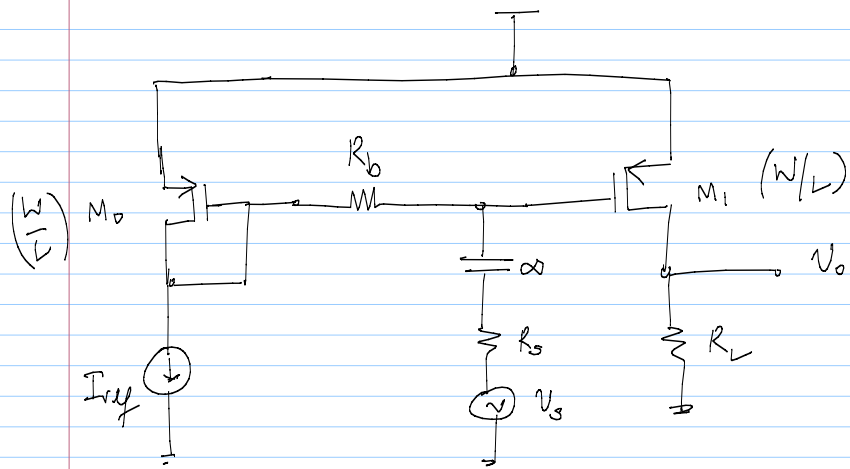
$$V_{y,q} \leq V_{x,q} + V_{TP} \Rightarrow I_D R_D \leq \frac{R_B}{R_A + R_B} V_{DD} + V_{TP}$$

## Bias Stabilisation

1)

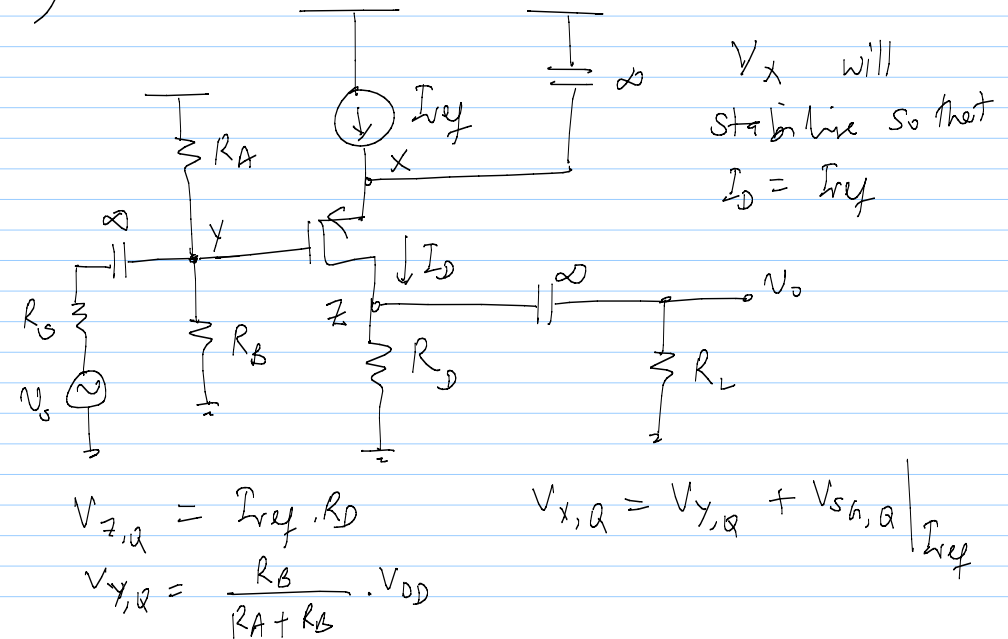


Current Mirror



Current Mirror

2)



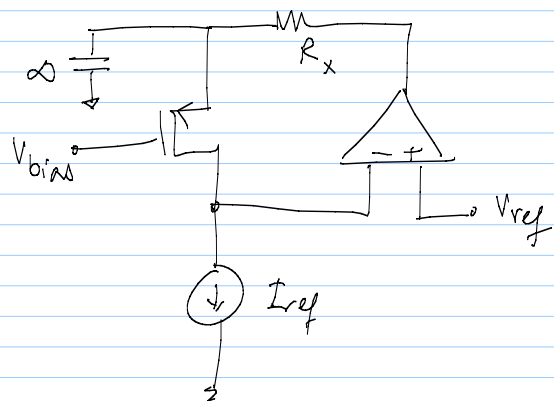
$V_x$  will stabilize so that  $I_D = I_{ref}$

$$V_{z,q} = I_{ref} \cdot R_D$$

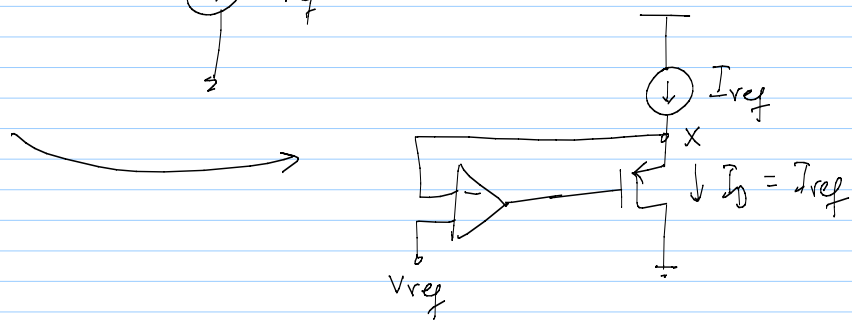
$$V_{y,q} = \frac{R_B}{R_A + R_B} \cdot V_{DD}$$

$$V_{x,q} = V_{y,q} + V_{s,q} \Big|_{I_{ref}}$$

3)

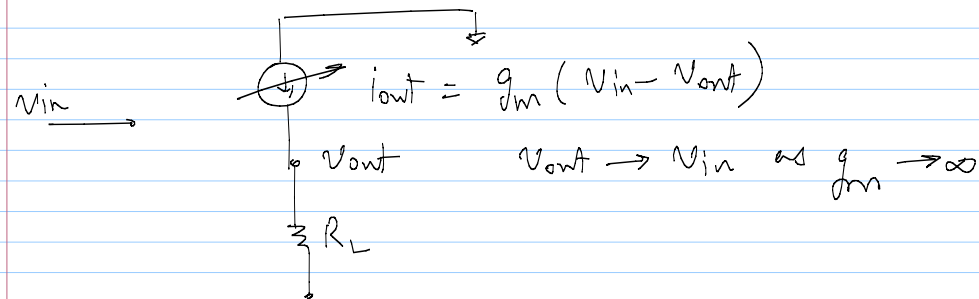


4)

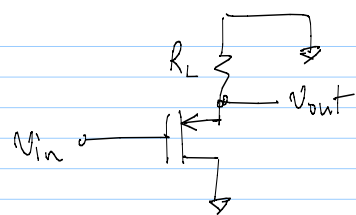
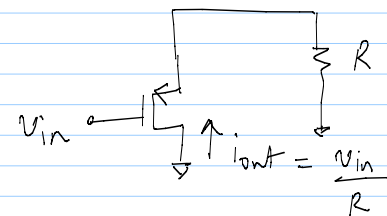
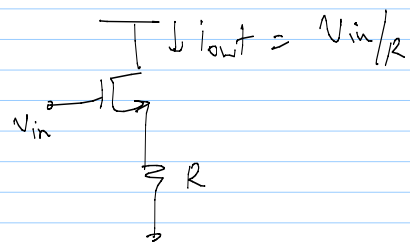


## Controlled Sources

1) VCVS of gain = 1



2) VCCS - Transconductance amplifier  
 $i_{out} = \frac{V_{in}}{R}$  ;  $Z_{in} = \infty$ ,  $Z_{out} = \infty$



"Common Drain Amplifier"

"Source Follower"

